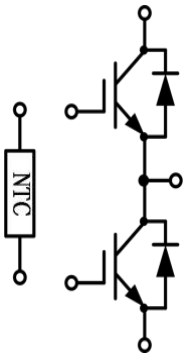
Econodual3 Half Bridge IGBT Module

V_{CES}= 1200V, I_C= 400A, $V_{CE(sat)}$= 1.8V

Features

- High Short Circuit Capability, Self Limiting Short Circuit Current
- High Current Density
- High surge current capability
- High Power Density
- Integrated NTC temperature sensor



Applications

- Commercial Agriculture Vehicles
- Motor Drives
- Solar Applications
- UPS Systems

IGBT, Inverter

Maximum Ratings

Parameter	Symbol	Test Condition	Value	Unit
Collector-emitter voltage	V_{CES}	T_{vj}=25℃, V_{GE}=0V	1200	V
Continuous collector current	I_{CN}	T_C=100℃, $T_{vj\,max}$=175℃	400	A
Repetitive peak collector current	I_{CRM}	t_P=1ms, T_{vj}=25℃	800	A
Gate-emitter peak voltage	V_{GES}	T_{vj}=25℃	±30	V
SC data	I_{SC}	V_{GE}≤15V, V_{CC}=800V V_{CEmax}=V_{CES}-L_{Sce}*di/dt, t_P≤10μs, T_{vj}=150℃	1600	A
Total power dissipation	P_{tot}	T_C=25℃, $T_{vj\,max}$=175℃	2055[1)]	W

Characteristics Values

Parameter	Symbol	Test Condition		Value			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	I_C=400A, V_{GE}=15V	Tvj=25℃		1.8	2.15	V
			T_{vj}= 125℃		2.1		
			T_{vj}= 150℃		2.2		
Gate-emitter threshold voltage	V_{GEth}	I_C=6.4mA, V_{CE}=V_{GE}	Tvj=25℃	5	5.9	6.5	
			T_{vj}= 150℃		4.2		
Gate charge	Q_G	V_{GE}=-8V/+15V			4.7		μC

Integrated gate resistor	R_G	T_{vj}=25℃		4.4		Ω
Input capacitance	C_{ies}	T_{vj}=25℃, f= 100kHz, V_{CE}=25V, V_{GE}=0V		46.7		nF
Output capacitance	C_{oes}	T_{vj}=25℃, f= 100kHz, V_{CE}=25V, V_{GE}=0V		2		
Reverse transfer capacitance	C_{res}	T_{vj}=25℃, f= 100kHz, V_{CE}=25V, V_{GE}=0V		0.41		
Collector-emitter cut-off current	I_{CES}	V_{CE}=1200V, V_{GE}=0V	T_{vj}=25℃		1	mA
			T_{vj}= 150℃		4	
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃			400	nA
Turn-on delay time	$t_{d\ on}$	I_C=400A, V_{CE}=600V, V_{GE}=-8V/+15V, R_{Gon}=1.4Ω,R_{Goff}= 12.9Ω , Inductive Load	T_{vj}=25℃	0.36		μs
			T_{vj}=125℃	0.38		
			T_{vj}=150℃	0.38		
Rise time	t_r		T_{vj}=25℃	0.09		
			T_{vj}=125℃	0.09		
			T_{vj}=150℃	0.1		
Turn-off delay time	$t_{d\ off}$		T_{vj}=25℃	2.5		
			T_{vj}=125℃	2.7		
			T_{vj}=150℃	2.7		
Fall time	t_f		T_{vj}=25℃	1.54		
			T_{vj}=125℃	1.2		
			T_{vj}=150℃	1.29		
Turn-on energy loss per pulse	E_{on}	I_C=400A, V_{CE}=600V, V_{GE}=-8V/+15V, R_{Gon}=1.4Ω, R_{Goff}=12.9Ω , Ls=35nH, di/dt=4600A/ μs (T_{vj}=150℃), du/dt=2000V/μs (T_{vj}=150℃)	T_{vj}=25℃	17.9		mJ
			T_{vj}=125℃	25.4		
			T_{vj}=150℃	35		
Turn-off energy loss per pulse	E_{off}		T_{vj}=25℃	91.2		
			T_{vj}=125℃	95.8		
			T_{vj}=150℃	99.9		
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.073	K/W

Diode, Inverter
Maximum Ratings

Parameter	Symbol	Test Condition		Value	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj}=25℃		1200	V
Continuous forward current	I_{FN}	T_C=100℃, $T_{vj\ max}$=175℃		400	A
Maximum repetitive forward current	I_{FRM}	t_P= 1ms		800	A
I²t-value	I^2t	V_R=0V, t_P=10ms	T_{vj}=125℃	35600	A²s
			T_{vj}=150℃	28000	

Characteristics Values

Parameter	Symbol	Test Condition		Value			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F=400A, V_{GE}=0V	T_{vj}=25℃		2.04		V
			T_{vj}=125℃		2.11		
			T_{vj}=150℃		2.08		
Peak reverse recovery current	I_{RM}	I_F=400A, V_R=600V, V_{GE}=-8V, diF/dt=6000A/μs (T_{vj}= 150℃)	T_{vj}=25℃		300		A
			T_{vj}=125℃		338		
			T_{vj}=150℃		357		
Recovered charge	Q_r		T_{vj}=25℃		36.4		μC
			T_{vj}=125℃		57		
			T_{vj}=150℃		64		
Reverse recovery energy	E_{rec}		T_{vj}=25℃		18.2		mJ
			T_{vj}=125℃		26.9		
			T_{vj}=150℃		30.2		
Thermal resistance, junction to case	R_{thJC}	per FRD				0.116	K/W

NTC-Thermistor

Parameter	Symbol	Test Condition	Value			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_C=25℃		5.0		kΩ
Deviation of R_{100}	△R/R	T_C= 100℃, R_{100}=493Ω	-3		3	%
Power dissipation	P_{25}	T_C=25℃			60	mW
B-value	$B_{25/50}$	$R_2=R_{25}\ \exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
B-value	$B_{25/80}$	$R_2=R_{25}\ \exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
B-value	$B_{25/100}$	$R_2=R_{25}\ \exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

Characteristics Values(Module)

Parameter	Symbol	Test Condition	Value			Unit
			Min.	Typ.	Max.	
Maximum junction temperature	$T_{vj\ max}$	-			175	℃
Temperature under switching conditions	$T_{vj\ op}$	-	-40		150	℃
Storage temperature	T_{stg}	-	-40		125	℃
Stray inductance module	L_{sCE}	-		22		nH
Module lead resistance, terminals-chip	$R_{CC'+EE'}$	T_{vj}=25℃, per switch		1		mΩ
Isolation test voltage	V_{ISOL}	R_{MS}, f=50Hz, t= 1min		2.5		kV

Creepage distance	ds	Terminal to heatsink		14.5		mm
		Terminal to terminal		13		mm
Clearance distance	da	Terminal to heatsink		12.5		mm
		Terminal to terminal		10		mm
Comperative tracking index	CTI	-		>200		-
Mounting torque for module mounting	M_1	Screw M5	3	-	6	N·m
Terminal connection torque	M_2	Screw M6	3	-	6	N·m
Internal isolation	-	Basic insulation (class1, IEC 61140)		Al_2O_3		-
Material of module base plate	-	-		Cu+Ni		-
Dimensions	LxWxH	-		152.1x62x20.8		mm
Weight	G	-		338		g

Typical Characteristics

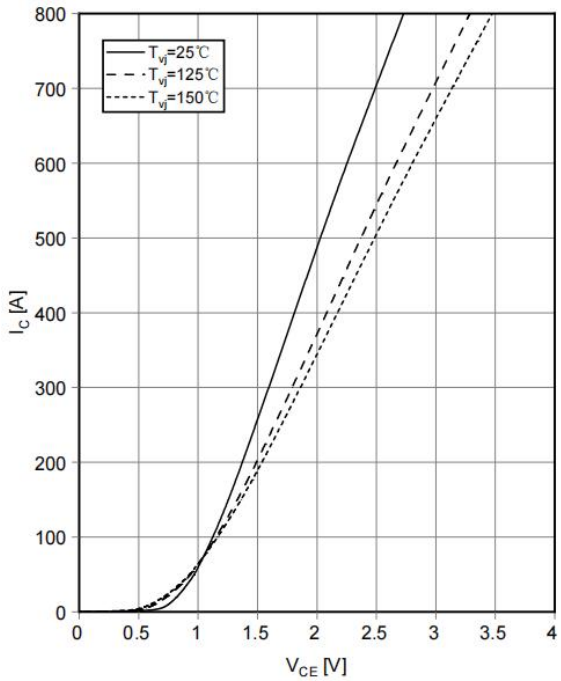


Fig 1. Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE})$, V_{GE}= 15V

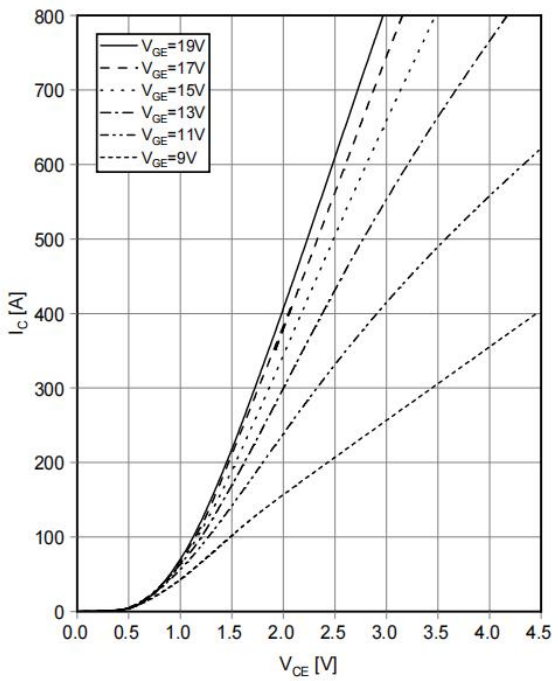


Fig 2. Output characteristic IGBT, Inverter(typical)
$I_C=f(V_{CE})$, T_{vj}= 150℃

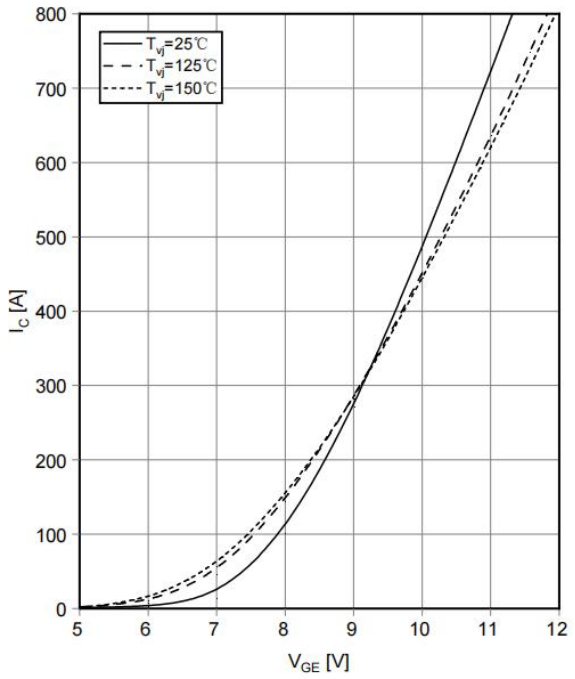


Fig 3. Transfer characteristic IGBT, Inverter(typical)
$I_C=f(V_{GE})$, V_{CE}=20V

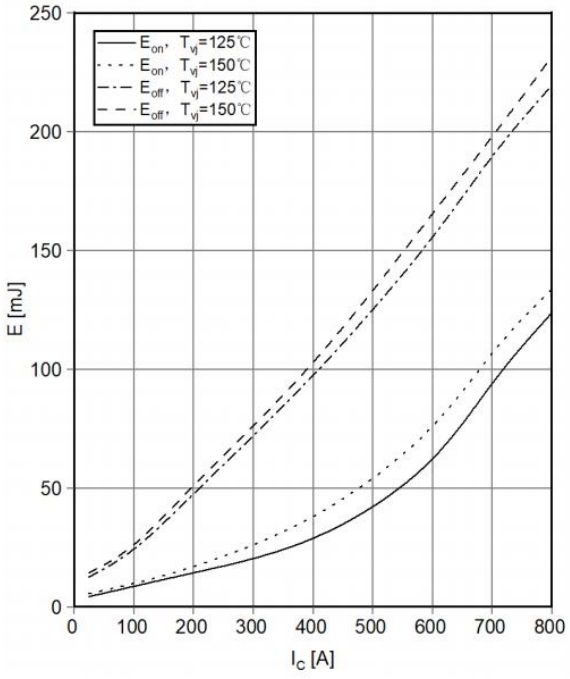


Fig 4. Switching losses IGBT, Inverter(typical)
$E_{on}=f(I_C)$, $E_{off}=f(I_C)$, V_{GE}=15V, R_{Gon}=1.4Ω, R_{Goff}=12.9Ω, V_{CE}=600V

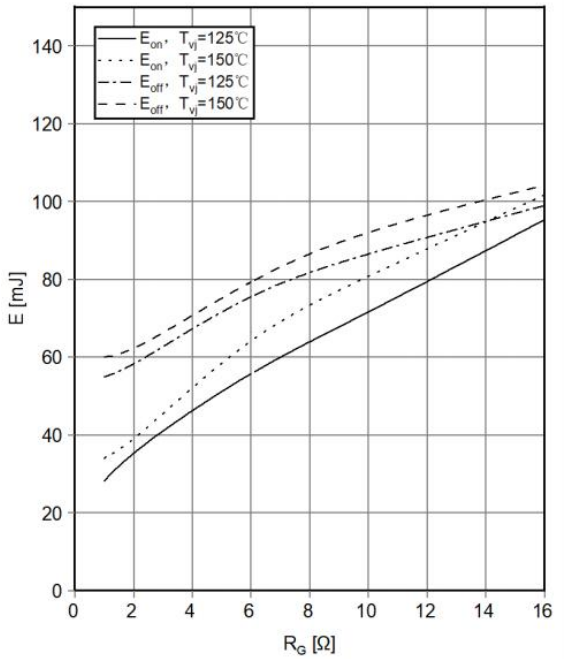


Fig 5. Switching losses IGBT, Inverter(typical)
$E_{on}=f(R_G)$, $E_{off}=f(R_G)$, V_{GE}=-8/+15V, I_C=400A, V_{CE}=600V

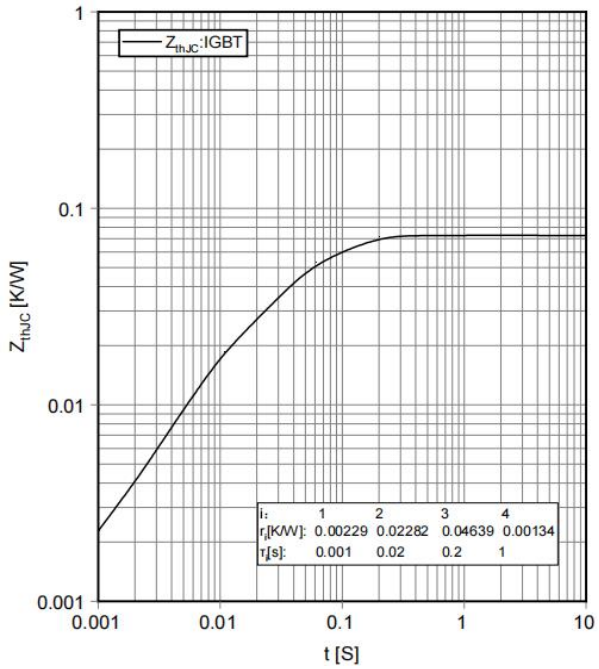


Fig 6. Transient thermal impedance IGBT, Inverter $Z_{thJC}=f(t)$

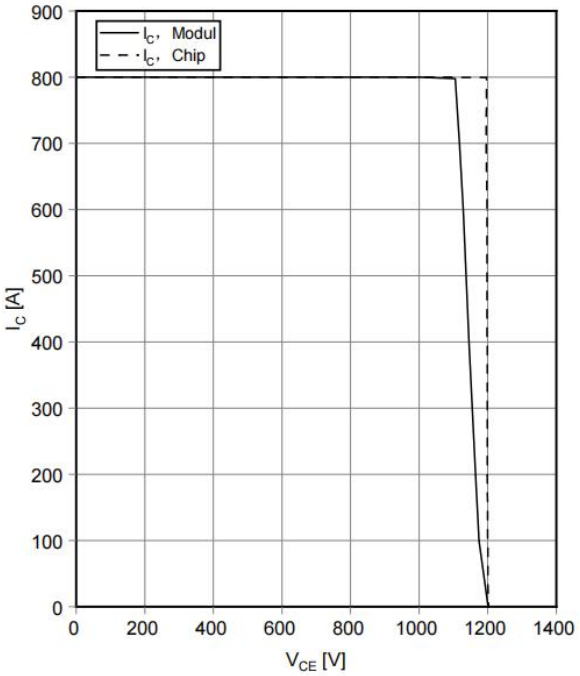


Fig 7. Reverse bias safe operating area IGBT, Inverter(RBSOA)
$I_C=f(V_{CE})$, V_{GE}= 15V, R_{Goff}=2Ω, T_{vj}= 150℃

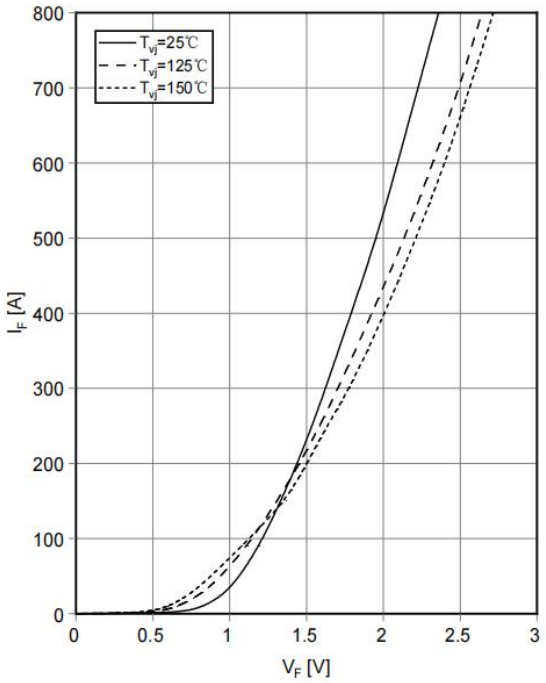


Fig 8. Forward characteristic of FRD, Inverter(typical)
$I_F=f(V_F)$

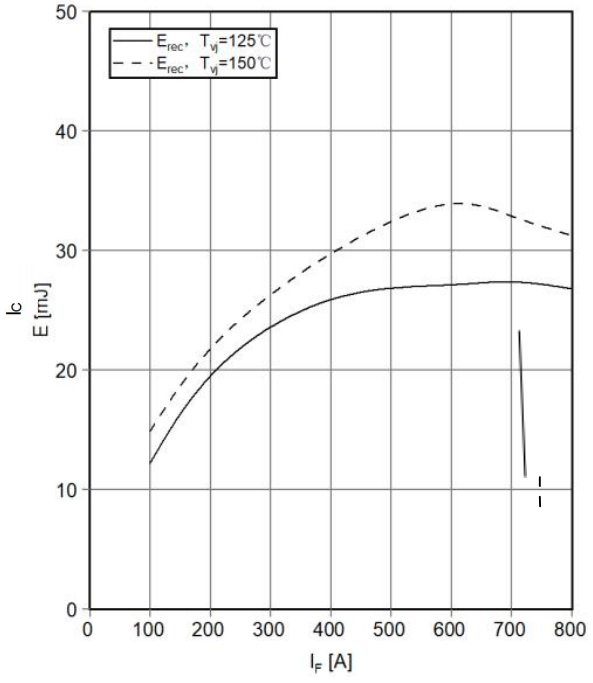


Fig 9. Transient thermal impedance FRD, Inverter
$E_{rec}=f(IF)$, R_{Gon}=1.4Ω, V_{CE}=600V

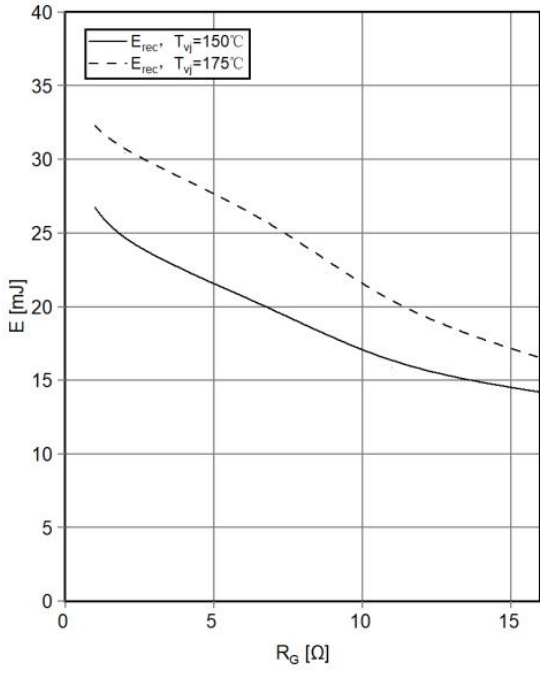


Fig 10. NTC-Thermistor-temperature characteristic
$E_{rec}=f(R_G)$, I_F=400A, V_{CE}=600V

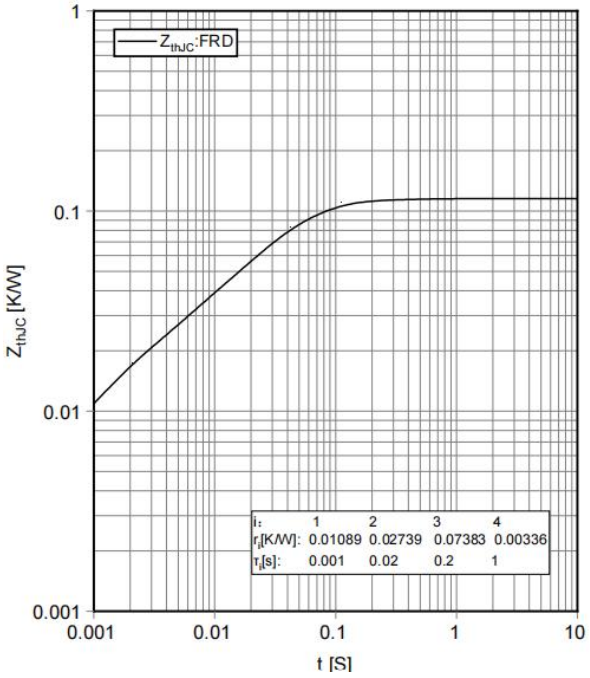


Fig 11. Transient thermal impedance FRD, Inverter $Z_{thJC}=f(t)$

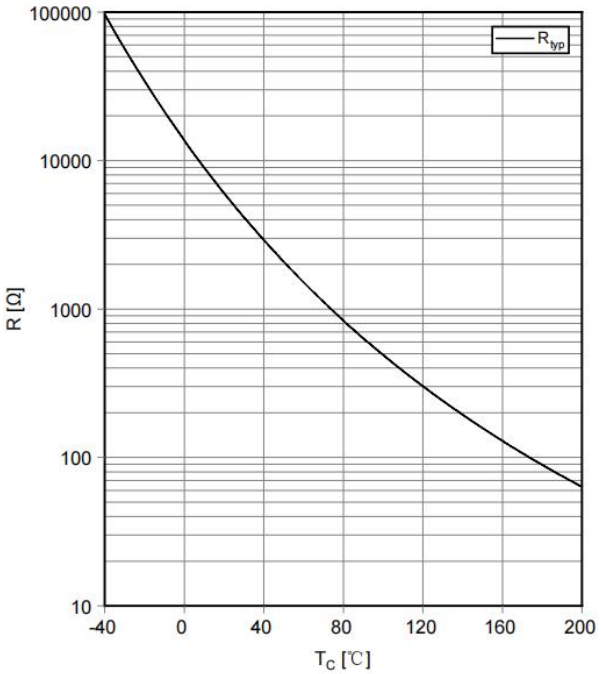
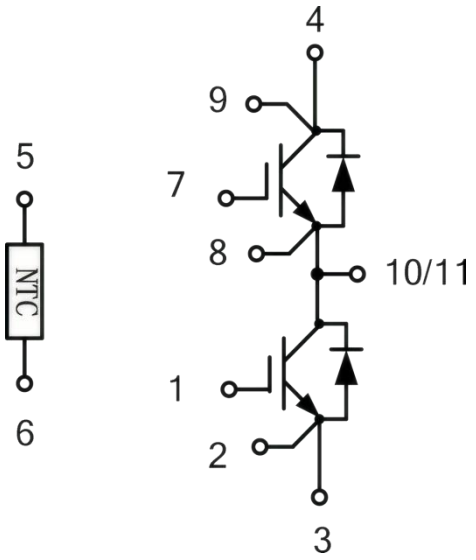
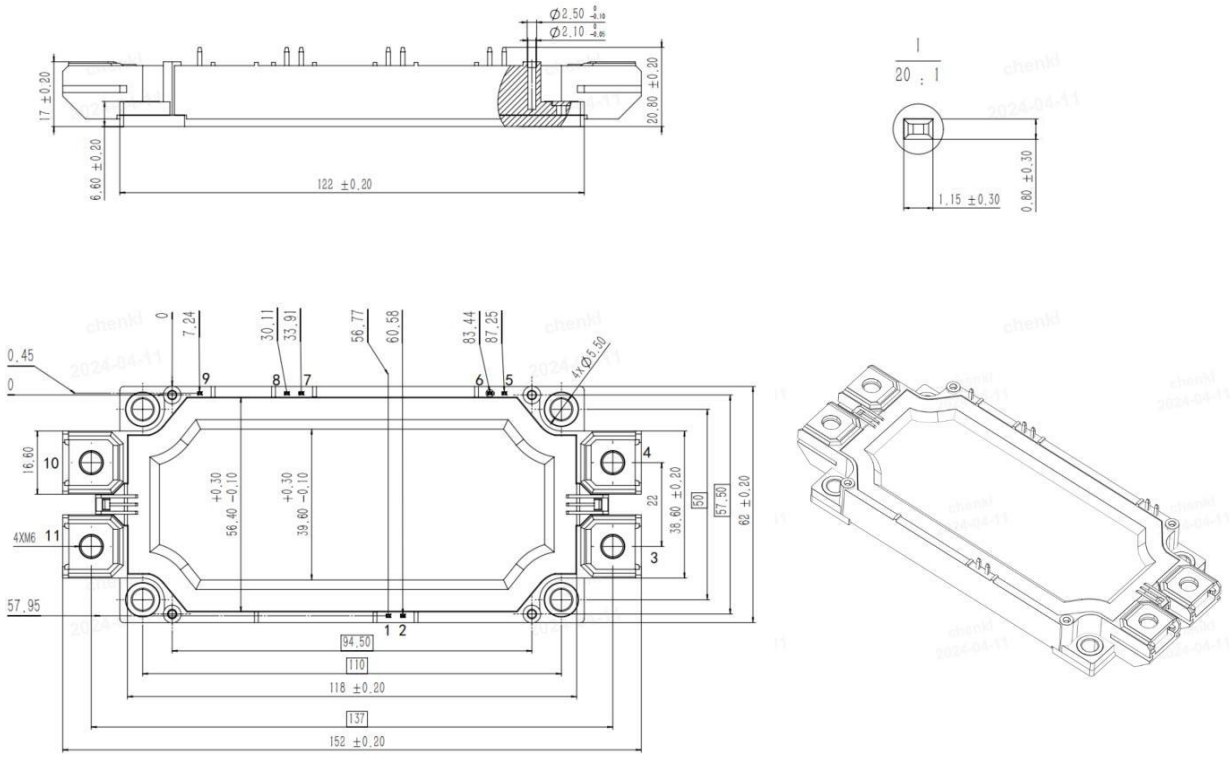


Fig 12. NTC-Thermistor-temperature characteristic R=f(T)

Circuit Diagram



Package Outlines(Unit: mm)



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